

Report on a
Geological Survey of the Lands of
Columbus National Petroleum Company
in Hocking and Vinton Counties

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REPORT
ON A
GEOLOGICAL SURVEY
OF THE LANDS OF THE
Columbus National Petroleum Company,
IN HOCKING AND VINTON COUNTIES.

BY LEO LESQUEREUX, GEOLOGIST.

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UNIVERSITY

GEOLOGICAL REPORT.

GENERAL REMARKS ON THE ORIGIN OF PETROLEUM.

"All authors," says Prof. Silliman, "who have examined the question of the origin and of the distribution of petroleum, agree substantially in stating that the transformation of organic matter, chiefly vegetable, imbedded in various strata of the earth, results in the production of rock-oil or petroleum, naptha, asphaltum or mineral pitch, all of which are forms of bitumen, the one being solid, the others fluid at ordinary temperatures."* Coal should have been included in the above enumeration of bituminous substances produced by the transformation of vegetable matter, for indeed the relation of coal to petroleum is so well ascertained that naturalists of high standing contend that, at a certain temperature, cannel coal is slowly transformed into petroleum, and that the deposits of oil in the coal-measures have been produced from the slow decomposition of some coal strata. This assertion, though perhaps not satisfactorily proved, is strengthened by these facts: 1st. That petroleum is generally found in connection with coal beds, even in coal-measures of different geographical epochs, as the oil deposits of California within the coal formations of the tertiary. 2d. That in our own coal-measures we find sometimes oil deposits at the base of beds of cannel coal, or within the porous sandstone underlaying those beds or their place. It is the case in the oil regions of the Muskingum, in Ohio, of the Kanawha, in Virginia, of the Big Sandy and some of its affluents

* Letter to Hon. Mr. Harris, 8th April, 1865, in U. S. Railroad and Mining Register, of Philadelphia.

in eastern Kentucky, as well as in Breckinridge county, near the Ohio river, in the western coal-fields of the same State. In those places, petroleum is often seen saturating the rocks of the Millstone-grit, or percolating from them, either making pools of oil at their bases, or appearing with the water of the springs which pass through this formation, or gush out at its base. Petroleum has been gathered for ages and in some quantity from these natural oil springs.

Contrary to this opinion, some geologists assert that petroleum can not have originated within our coal-measures and from the decomposition of coal beds, and that the rocks of this formation have been impregnated with oil forced up by the expansion of the gas which constantly originates from this substance. As we know that petroleum is found with the coal of different formations—tertiary, cretaceous, &c—it is evident that this opinion can not be sustained.

The difference between coal and petroleum is most probably the result of a difference in the nature and substance of the plants which have entered into their composition. Plants living above water, or terrestrial plants, fix the carbonic acid of the air and water which they absorb, and transform it into carbon or woody matter;—they make wood. By a slow process of decomposition, the wood is changed into coal. Plants living in either fresh or salt water are merely cellular, have no woody fibre in their tissue, and, by the same slow process of decomposition, they produce bitumen in its different forms,—petroleum, asphaltum, etc. Hence we see that oil-producing rocks generally contain remains of sea weeds or Fucoids, while the shales and sandstones overlaying coal beds bear remains of ferns, of trees of various forms and species. There is in the coal-measures a peculiar plant named *Stigmaria*, whose remains are seen in immense quantity in the fire clay at the bottom of the coal beds, and also within the so-called *cannel coal*. These plants were floating plants; mixed with some other species, they have entered mostly into the composition of *cannel coal*, and wherein they have lived by themselves alone, without being mixed with mud and silica to

constitute clay, or with other plants to make coal, they have given origin to the oil deposits of the true coal-measures. This supposition explains satisfactorily the relation of cannel coal to rock-oil, and its slow transformation into petroleum, under certain circumstances. For, sometimes, as is the case at Breckinridge, in Kentucky, cannel coal is a mere compact bitumen, mixed with some fixed carbon, and scarcely distinguishable from asphaltum. On the other hand, the Devonian black shales are sometimes so compact and charged with bitumen that they burn like coal, leaving, nevertheless, a great portion of residue, which does not consume and is pure shale. In the first case we have a compound of bitumen and a small proportion of woody matter; in the second, a compound of bitumen and a large proportion of earthy matter or mud.

GEOLOGICAL DISTRIBUTION OF THE DEVONIAN OIL-BEARING ROCKS IN NORTH AMERICA.

Though much has been written, and is still published every day, on the question of the distribution of petroleum, we know little indeed concerning the relation of our oil deposits with those of Pennsylvania, and this question, "*Do we have a true Devonian petroleum region in Ohio?*" is still unanswered. Till now, all the oil obtained in our State, as well as in north Virginia and east Kentucky, is from the true coal-measures, or from their base, the Millstone-grit. The deposits of thick lubricating oil of this formation have been found valuable and remunerative at some places. But we want something more, and it would be of great importance for us to know if the bituminous black shales, the so-called Devonian or Worthington black shales, well developed in Ohio, all along and near the borders of our coal basins, from Lake Erie to the Ohio river, are true originators and receivers of petroleum. Do they promise, in some peculiar localities, to reward labor and cost of boring by such a flow of oil as has enriched the famous Venango county of Pennsylvania, or the Chatham fields of Canada?

Some few borings have been begun, and many wells already placed in the belt of country which I consider as the Devonian oil regions of Ohio, but we cannot know yet by results what their productiveness may be. It is then only by geological test, or by comparison of our Devonian measures with the oil-bearing rocks of Pennsylvania, that we can appreciate the chances of future development of the petroleum business in our State. To render this comparison comprehensive, it is best to admit the description and names of strata as they are given by the State geologist of New York; for it is from their works that we have obtained most of our knowledge of the Devonian formation of this country.

Under what is generally called the Devonian black shales, we have first a limestone of great thickness, which is a part of the *Corniferous* formation. It is as well developed in Ohio as in Pennsylvania, but not quite so thick, perhaps, as in Canada. Our quarries of Columbus expose this limestone, with its peculiar fossil fishes and shells, its irregular masses of siliceous porous rocks, its surface-caverns, filled there with fragments of limestone and peroxyd of iron. Over this limestone there is, in Pennsylvania and New York, the *Hamilton formation*, consisting, 1st, of a lower member of generally black, very bituminous shales (Marcellus shales), containing remains of some large trees, and sometimes traces of coal; 2d, of a middle member, the Hamilton beds, a compound of shales of various kinds, flagstones, even a thin bed of limestone; and 3d, of a third member, the Genesee shales, also generally black and bituminous. According to measurements of the New York State geologists, the Marcellus shales are rarely more than 50 feet thick, at least near Lake Erie, the Hamilton beds, in the same country, are 500 feet thick, and the Genesee shales only 25 feet. Our black shales of Ohio are also characterized by remains of large trees, traces of coal, and the great amount of bitumen which they contain. They, moreover, overlie immediately the Corniferous limestone, and appear as the representative of the Marcellus shales, and certainly also of a part of the Hamilton beds, and

probably of the Genesee shales. Their thickness in Hocking and Vinton counties is from 250 to 330 feet. Thus we have in Ohio, say 300 feet of measures representing the 575 feet of the Hamilton formation as it is along Lake Erie, and probably also in the Pennsylvania oil regions, and marked by the same essential characters. It is from the formation under these black shales, or from the Corniferous measures, that the oil is obtained in Canada, and from the formation above, or from the base of the Chemung, that Oil Creek, Venango county, Penn., derives its wells of petroleum.

This Chemung formation of the New York geologists is composed of a lower part, the Portage group and an upper one, the Chemung proper. It is of great thickness in Pennsylvania and New York. In the Venango oil fields, from data obtained by borings, it appears to be from 1,000 to 1,200 feet. Prof. Jas. D. Dana, in his *Manual of Geology*, speaking of this formation says, (page 288) "*Westward of New York, the Portage and Chemung groups have been supposed to be represented in Ohio by a sandstone called the Waverly sandstone, three to four hundred feet in thickness. Many facts, however, point rather to the conclusion that the larger portion at least of this series, really belongs to the subcarboniferous, or is at any rate newer than the Chemung.*" From what I know of the Knob sandstone of Kentucky, which is the equivalent of our Waverly sandstone, I was already in doubt concerning the value of this assertion. But recently in following and studying this formation from its base at Circleville, Pickaway county, where it is seen overlaying immediately the black shales, to its top, near the base of the Millstone grit at Rockhouse, Hocking county, I have found its characters so fully agreeing with those marked for the Chemung, that I do not doubt now of the identity of this formation of our's with that of New York. "*It abounds in ripple marks, obliquely laminated layers, mud marks and cracks from sun drying. It has, as the Portage group, great number of Fucoïdes or forms regarded as fucoïdal; the most common kind appears like short, straight, simple stems, two or three inches long, scattered thickly over the*

surface of the sandstones. In the upper Portage, there are other cylindrical forms penetrating vertically the layers, but these are probably the fillings of worm holes." This description is copied from the same Manual of Geology of Prof. Dana and is a perfect resume of the characters of this group, as indicated by the New York geologists. At the same time it agrees so well with the characters of our Waverly sandstone, especially in Hocking county, that it would seem as if it had been made from its examination. At the base of the formation, half a mile east of Circleville, we find already those peculiar marine plants, ripple marks, etc., and see them all along the road for about ten miles to the mouth of Laurel creek, where a bed of shales, flagstones, carbonate of iron, blue clay, etc., is exposed, seventy-five feet thick, and where the shales and shaly sandstones are most entirely covered with the same species of *Fucoides*. It is well to remark that the distribution of these marine plants occupy a very large vertical space, and that they might be found in the subcarboniferous perhaps. For I have been misled by their appearance, even at the base of the true coal measures. But the subcarboniferous strata are of quite a different nature. And how are we to compare measures or formations at great distance, or when they appear only at wide intervals, if we have to put aside as unreliable what is generally conceded as satisfactory characters to authorize the admission of identity. We have here the same lithological appearance in the nature of the stone and the strata. In Ohio, as in Pennsylvania, a soft sandstone of a peculiar buff color, alternating with shales of various kinds, flags, ironstones, blue clay, etc.; the same geological distribution; for in Pennsylvania they have over what they call the Chemung, 20 or 30 feet of subcarboniferous measures, a peculiar kind of black soft shales containing oval pebbles of carbonate of iron, separated from the base of the Millstone grit by 5 to 6 feet of clay iron ore or ball ore, and under or within these shales sometimes a thin bed of coal. It is precisely what we can see at the base of the Millstone grit, below Rockhouse, and this agrees per-

fectly well also with some parts of the measures of the eastern Kentucky coal fields, where the subcarboniferous limestone has not yet made its appearance. I quote a few passages from my Kentucky geological report (vol. 4, p. 341): "Three miles south of Jas. Wells, near the eastern limits of Montgomery county, a bed of coal 22 inches thick rests immediately upon a soft, buff-colored sandstone, containing in great abundance shells of the Chemung group, which at this place overlies another bed of sandstone covered mostly with *Fucoides Cauda-galli*."* And further, p. 342, "In the hills just opposite the house of M. S. Wells, the formation containing *Fucoides Cauda galli*, about 100 feet thick, rests upon the lower subdivision of the Chemung group and is overlaid by a conglomerate sandstone, etc. In these hills there is no trace of coal or of limestone, (subcarboniferous); but on the road to McCormick, in crossing the hills between Slate and Beaver creeks, the limestone makes its appearance, with a stain of coal above it." This limestone, the real subcarboniferous formation or its essential part, is absent in Hocking and Vinton counties, and also in Pennsylvania. But southward, along the coal measures of Kentucky, it appears and always separates the coal measures from the Chemung. When it becomes thicker and is in two or three different strata, as under the coal formations of western Kentucky, Indiana and Illinois, its strata are separated by shales of a peculiar nature, where till now no traces of *Fucoides* have been seen, and by sandstone beds, which contain remains of large land plants, *Lepidodendron*, *Calamites*, etc., species which characterise the true coal measures. Why then, and on what ground, should we separate those formations of Ohio, agreeing in position, in nature and composition of strata, in fossil remains also, with those of Pennsylvania, at Oil creek, to give them another name and regard them as of different age. I consider their identity as fully established though there

* This plant is considered as characteristic of the lower carboniferous formation, but ascends much higher. At A. M. Wells' the black shales are about 500 feet lower than the sandstone with *Fucoides*.

is a difference in thickness. In the oil regions of Pennsylvania, they have, as already stated, 1,000 to 1,200 feet or perhaps more; in Hocking county, Ohio, about 600 feet.

I may err in supposing that for Ohio and for Pennsylvania also, the black shales of the Devonian, either the whole of the Hamilton formation or only a part of it, are the essential generators of Devonian petroleum. Some Geologists admit that the Chemung of Venango county contains, at different horizons, sandstone beds separated by oil-bearing shales and if it is the case, our six hundred feet of Chemung-measures may contain also one or more horizons of oil. Nothing but actual experiment can determine this; * but certain it is that the black shales of Ohio are generally so much charged with bitumen that they burn sometimes like coal or have been quarried for distillation of oil in retorts. Many springs, coming out of them, bring oil with their water. Wherever, then, these shales have been and are still overlaid by strata of the Chemung, in sufficient thickness to have prevented the dispersion of bitumen through the surface, either by gas or by springs, this bitumen, to my belief, is concentrated in more or less great abundance either in the porous sandstone and their cavities above the shales, or in the caverns of the limestone below it, as in Canada. The little we know from experience of that oil region of Ohio seems to confirm this opinion. The sandstone near the base of the Chemung has its surface sometimes blackened by a coat of condensated or oxidated petroleum or asphaltum, and in the quarries also in the same position, one sees often traces of oil brought up with water through the sandstone. One well bored in Hocking county, opening at one hundred and twenty feet lower than the base of the Millstone-grit, has reached a fine show of oil at one hundred and thirty feet, and in East Kentucky, where the Devonian black shales have the same thickness as ours, a well, bored in Estill county, passed fifteen feet soil, one hundred feet black shales, one hundred feet light clay limestone, one hundred and ninety feet grey limestone,

*J. P. Lesley, Proceedings American Philosophical Society, Vol. 10, p. 57.

when the auger dropped, salt water gushed out and soon gave way to the present continuous flow of oil.*

Borings begun just above or within the black shales, or too near their surface from the base of the Chemung may have been unproductive. I know of but one in Pike county, Ohio; but this unproductiveness is mostly due, as said above, to dispersion of the petroleum through the surface. From the base of the Millstone-grit, at and around Rockhouse, Hocking county, a number of small pretty deep valleys shedding their waters to Salt Creek, descend by soft slopes from two to three hundred feet below the base of the Conglomerate. It is this part which I have especially examined, which presents great likeness of topographical and geographical configuration with Oil Creek, and which is likely to become one of the richest oil fields of Ohio.

LANDS BELONGING TO THE COMPANY.

The selection of these lands has been very judiciously made. It could not indeed have been more successfully done by a practical geologist. In my belief, there is not one acre of them, where the upper strata overlaying the oil rocks are too heavy to interfere with the boring and render it too expensive, nor any place where they are so thin that the oil may have escaped through them as gas. In the upper part of the valleys, the surface generally lies at from fifty to one hundred feet below the base of the Millstone-grit and descends by gradual slopes from fifty to one hundred and fifty feet lower. Such a position is by itself of marked advantage, for it does not necessitate the use and transportation of too heavy and costly engines and it reduces a great deal the expenses for first researches. Borings made from above the millstone-grit, and some are now begun six to eight hundred feet above these measures, have to go down twelve to fifteen hundred feet before reaching the deposits of the Devonian oil. They have chances of passing cavities filled with coal petroleum; but these chances appear very few indeed. From the measurement which accompany the description of the

*Kentucky Geological Report p. 472.

land of the company, and from what has been said of the average thickness of the Devonian-measures, it will be easy to know, for every place, the depth to which borings will have to go, to reach the oil-bearing rocks.

Another advantage, in the position of the lands, is the uniform and slow grade of the valleys, which are all accessible by good roads. As will be seen by the map, the lands are situated mostly on the runs or affluents of Salt Creek. Every part of the country has easy access either to the Marietta and Cincinnati Railroad on the south, or to the Hocking Valley Canal on the north-east. Compare this with what we see in some parts of the oil regions of Pennsylvania, where the bottom of the creeks is so narrow that there is not even a space along the banks for the erection of a derrick, and where the slopes on both sides are so steep and high that it is not even possible to take a horse down to their base. Or with what we hear of the Virginia oil regions around Burning Spring, which cannot be reached but by such bad roads that the hauling of a barrel of oil to the Ohio River cost not less than \$3 50.

The general direction of the valleys where the land of the company is placed is to the south a little west, except for Pike Run, which descends south-east to the west side of Salt Creek, and for Buck Creek, which runs eastward to the Hocking River, (see map). These valleys are not too deep and too narrow, and also not too flat; they have generally a pretty large bottom with space enough for placing as many wells as may be desirable, and are bordered by hills varying in altitude from two to three hundred feet, mostly well timbered. The water courses head mostly around Rock House, Hocking county. It is from this place that the detailed examination begins.

LANDS ON LITTLE PINE CREEK.

The creek was reached at its head waters, after crossing a divide formed of carboniferous and Millstone grit formations. The valley is generally narrow and pretty deep, bordered on both sides with steep hills about 300 feet high. The most ele-

vated part of the property there, at Ansil Call, is 240 feet lower than the top of Rockhouse and 80 feet below the base of the Millstone grit. It has a round, gradually inclined bottom at the union of converging branches, which is thus surrounded on three sides by the highest hills of the valley. This place is probably one of the most promising for successful borings.

From the land at Ansil Call to the mouth of Little Pine, the difference of altitude is 140 feet. In descending, the bottoms become a little broader and the hills not quite so high and steep, but the general character is preserved on the whole length of the creek.

On Miller's farm a well has been opened by the Company, in the confluent of two branches, 40 feet above the bed of Little Pine creek, on the eastern side of the valley, at 180 feet from the base of the Millstone grit. When we passed it, it had reached only 34 feet. On one of the same branches, one-fourth of a mile above the boring, on land of Cave and Haselton, there is a spring which constantly brings out gas and drops of oil. In pressing with a stick on the bottom of the spring, this show of oil becomes pretty well marked. As this spring is 150 feet lower than the base of the conglomerate measures, which here around are not in place at the top of the hills, it is evident that this surface oil comes from the Devonian, and has no relation with the thick petroleum of the coal measures. It may be stated here, moreover, that no trace of petroleum has been remarked in the whole measures of the Millstone grit of this country, though this formation is generally well developed. This is due probably to the barrenness of the overlaying coal measures where the coal is thin and rare.

LANDS ON BIG PINE CREEK.

On the lands of the Company, on this creek, the Millstone grit is somewhat lower; the hills are not quite so high and so steep, and the bottom broader; but the general character of the country is the same as at Little Pine creek. There are also on the land of the Company many gas springs. I examined one on lot No. 10. They have also some show of oil

at Moore and Burgoon's, and at Philipps's. The thickness of the Millstone grit generally well developed and curiously weathered in the most peculiar forms is, here, from 50 to 70 feet.

LANDS ON QUEER CREEK.

The divide from Big Pine to Queer creek is, at its top, 300 feet above the bottoms of the valleys. Crossing it and descending to Bloomingsville, at the confluent of Goose and Queer creeks, the Millstone grit is passed 100 feet above the village. This valley of Queer creek is still broader than that of Big Pine; but the hills on both sides are steep and of the same altitude. The carboniferous measures, overlaying the Millstone grit, have here a thickness of 150 feet, and contain generally two beds of coal. One two feet thick, near the top of the hills on Pretty Run; another only six inches, said to be at the base of the Conglomerate. The bed of coal, two feet thick, is opened four miles from Bloomingsville, and could furnish fuel for the engines in case of scarcity of wood; an event at least very remote, as the greatest part of the slopes of the valleys is now covered with splendid forests.

A well bored just near Bloomingsville is already down to 220 feet, having passed the following strata:

- 20 feet, sand and gravel.
- 5 " gray sandstone.
- 5 " slate.
- 80 " blue rock (sandy shales.)
- 110 " Waverly sandstone.

Thus with 100 feet of measures from the mouth of the well to the base of the millstone grit, we have already a section of 310 feet, which, with the exception of about 20 feet of sub-carboniferous shales, is all Chemung. I cannot say that this well promises good results. It has been bored just in the direction of a lateral branch, and already the bore has passed a few springs of fresh water; the lower one very abundant, which is likely to interfere with the work. A good, experienced engineer and miner would be of great advantage for directing these first borings and giving them a forward im-

pulse. It is generally conceded now in the oil regions, that the less experienced miners, with cheap and poor engines, give to the Companies a deal of trouble, and at the end cost more than the best workmen and more powerful engines. They generally arrive at unsatisfactory results. Slow work ruins the well, especially when water and gas springs have been passed.

LANDS ON PRETTY RUN.

On the head waters of this creek the Company owns some land at Nungister and Wakefield, which, from barometrical measurement, appears to be above the Millstone grit. But here these measures are thin and scarcely formed, for only 20 feet lower, at Dr. Patterson's land, the Millstone grit, only 10 feet thick, has its base just above the level of the creek. The general configuration of Pretty Run is much like that of Little Pine Creek, at least at its upper part. On Dr. Patterson's farm the bottom of the valley is about one-eighth of a mile broad, bordered on both sides by pretty steep hills, 250 feet high. At Wolf farm the hills lower and the valley opens more and more, till at Vanderfords, near the mouth of the creek, the bottom is at least one-fourth of a mile broad, bordered by low hills in cultivation, and no higher than 100 feet. On this land the creek is 20 feet above the level of Salt Creek, near the bridge, and this stream is at the same place 130 feet lower than Bloomingsville, and 220 feet from base of Millstone grit.

LANDS ON PIKE CREEK.

Like Pretty Run, it is open at its lower end, becomes narrower, and bordered with higher hills in ascending, and has a fine appearance for boring. A well has been opened on this creek, 60 feet above the level of Salt Creek, 160 feet below base of the conglomerate. It has reached only 130 feet, and already promises favorable results. The bore passed, first, 70 feet of sandstone, then 30 feet shales, and now is again going through sandstone. Gas began to come out at 100 feet, and it now brings oil with it. This is a favorable sign,

indicating, of course, deposits of oil at a lower level. This well is placed seven miles south of Adelphi, and eight miles from the Marietta and Cincinnati Railroad. About half a mile above, on the confluent of two branches, at Morris's, the land which there belongs to the Company has still better appearances for successful borings. It is 40 feet higher, bordered by higher, steeper hills. In ascending to Arledge, (10 feet) the valley has the same form, and here it enlarges to Cox's, 20 feet higher up, where the hills become higher and the valley divides. The land here, also, is of very good appearance. Still higher up, the valley becomes narrow and rugged. Two tracts of land of the Company are located there, one at 130 feet, the other at 225 feet higher than at Cox's. The top of the divide of Pike Creek is 510 feet above its mouth at Salt Creek; and this is 150 feet lower than the mouth of Laurel Creek, near Adelphi.

LANDS ON LAUREL CREEK.

The valley of Laurel Creek, below the village of South Perry, is much expanded, and is flanked on its left side by a continuous range of wooded hills, 200 to 300 feet high, cut here and there by ravines. On its right side the range of hills is lower and undulating. Above the village the valley becomes narrower and the hills higher, being capped by rugged masses of conglomerate. The lands on this creek, owned by the Company, are about half a mile in width and four miles long; and in view of their surface indications and their favorable geological position, they appear to be the most valuable of any belonging to the Company.

In conclusion of this report, I beg to be allowed to make a remark more, as an excuse of its length. My influence, if I had any, would never be cast against investment for the investigation of the oil regions of Ohio, which, when developed, will enrich our State in the same manner as the development and product of petroleum has peopled and enriched some counties in Pennsylvania. But being unacquainted, as is every geologist, with the nature of our oil-bearing meas-

tures, I had not a favorable idea of their value. It was then agreed that if this opinion should be confirmed by an examination of the land, I should not be called to make any report. Of all the States of America, Ohio is the only one whose geology has been most neglected, and is still a true *terra incognita*. To this ignorance, the general indifference toward our mineral deposits of Ohio is certainly attributable. My views having been totally modified by the exploration made of the part of the country referred to in this report, I had, of course, to explain the cause of this change of opinion, and it was not possible to do it without the scientific considerations by which it was forced upon me.

LEO LESQUEREUX.

APPENDIX.

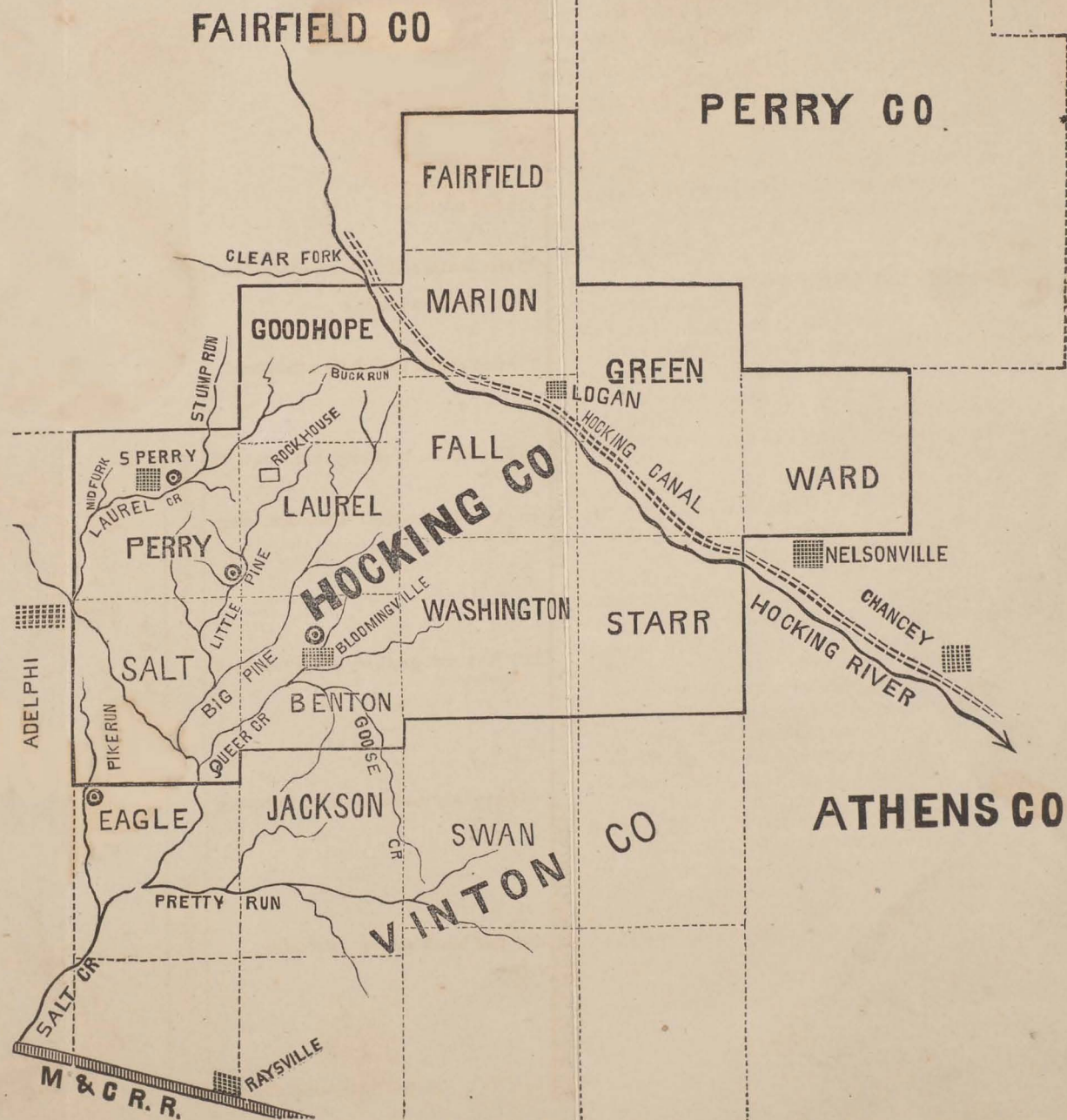
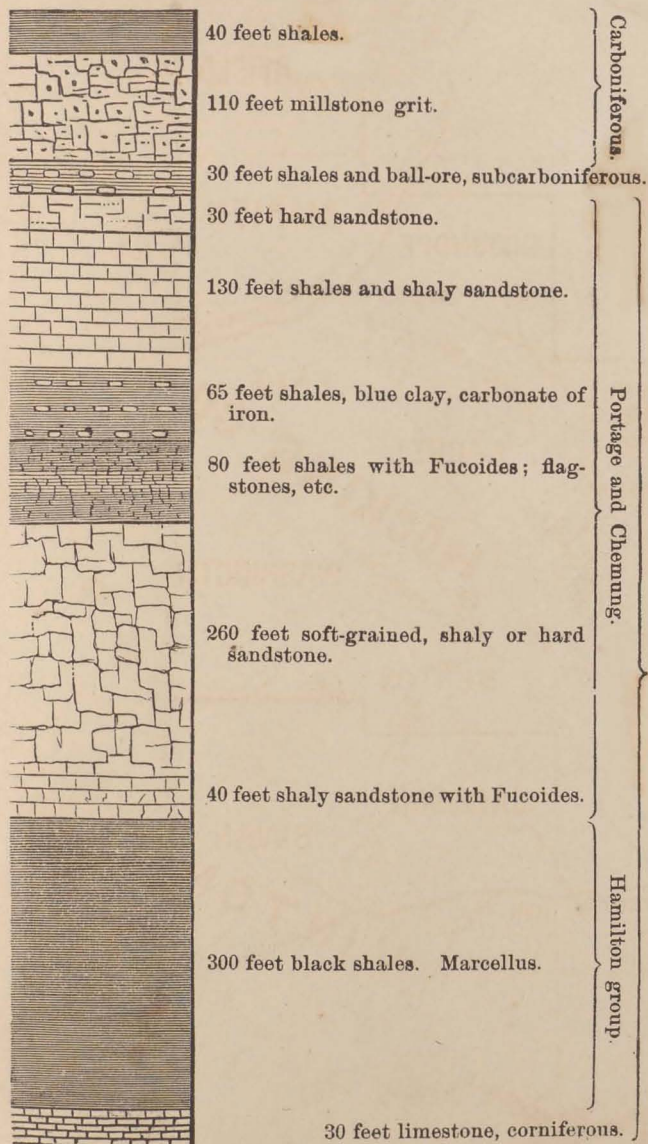
In the foregoing report, some tracts of land belonging to the company have been omitted, because, from want of time, they had not been as carefully examined as the others. Three of these tracts, of Ebert, Wiggin, and Harmon, lie on Salt Creek, below mouth of Laurel, about 200 feet lower than the base of the Millstone-grit, in an open valley having the general features of the lower part of Laurel Creek. The other tracts, of Hoy, Toling, etc., on the north branch of Little Pine Creek, about 100 feet lower than the base of the Millstone-grit. There the hills are higher, the valley narrower, and the configuration of the country is exactly the same as that of the main branch of Little Pine.

In re-examining lately some parts of the company's land, and reviewing my former conclusions, I have found nothing which might induce me to modify my views. On the contrary, new facts have come to my knowledge evidently confirming them. At Adelphi, Ross county, at the creek south of and 95 feet lower than the town, is exposed a bed of shales having the same characters and the same Fucoid plants as at mouth of Laurel Creek. In comparing the specimens with those brought from Oil Creek, the identity of species is evident. On top of the hills, 190 feet above the creek, there are some loose pieces of limestone, apparently in place, and belonging to the sub-carboniferous limestone. Here we have, as at Laurel Creek, 175 to 190 feet of shales of the Chemung, overlaid by the true sub-carboniferous measures, whose thickness can not be ascertained, because at Adelphi the hills are not high enough to reach the base of the Millstone-grit.

It may be well to mention that in Ross county, especially at and around Kingston, the black shales of the Hamilton group even at some of their exposures at the base of the Chemung, where they have been exposed for a long time to atmospheric influence, still bear remarkable evidence of their capacity as oil-producing and receiving rocks. They burn readily, and oil has been seen percolating from them in the springs. It may be that this superabundance of petroleum, where it has not been exhausted by atmospheric influence, has been gathered and is preserved in the cavities of the limestone underlying the shales. The base of the Chemung follows nearly directly from Kingston to two miles east of Circleville, and on this line borings, after passing through about 300 feet of black shales, have chances of reaching, within the limestone below, such oil wells as that bored in Estill county, Kentucky, as reported on page 10. It would be worth examining the matter; and as some companies have leased land on this formation of black shales, in Ohio as well as in Michigan, the results of their borings may be considered as a test of the greatest importance for our country.

LEO LESQUEREUX.

Geological Section showing distribut'n of Carboniferous and Devonian measures in Pickaway, Hocking and Vinton counties, O.



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